Beliefs and Experiences of Individuals Following a Zero-Carb Diet: An Online Qualitative Study

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Abstract

An increasing number of people eat diets that restrict carbohydrates. A variant of these diets, the *zero-carb* diet, aims to severely limit, or even exclude entirely, carbohydrate. This study aimed to investigate the beliefs and experiences of people eating zero-carb diets for at least 6 months and to define a zero-carb diet. Zero-carb dieters ($N = 170$) recruited from a social media platform completed an online survey. Participant responses were thematically analyzed. Results revealed that participants were driven by health concerns to uptake the diet and adhered to the diet for its health benefits. Moreover, participants expressed a strong social identity and belongingness to online zero-carb communities. Shortcomings of the diet centered on social stigma, lack of support from health-care providers and significant others, limited access to, and high cost of, foods, and lack of empirical support for the diet. Participants reported strong intentions to follow the diet indefinitely. We recommend further research into the benefits and shortcomings of zero-carb diets across settings and populations, and into developing guidelines for healthcare professionals to support individuals wishing to eat zero-carb diets.

Keywords: Carbohydrate restriction; ketogenic-type diets; wellbeing; quality of life; thematic analysis; theory of planned behavior

1. Introduction

Dietary guidelines generally recommend a reduction in fat and red meat consumption and an increase in carbohydrate consumption to promote good health (Cohen, Cragg, deFonseka, Hite, Rosenberg, & Zhou, 2015). These recommendations have been based on theoretical links between fat consumption and higher coronary heart disease risk (McGovern, 1977), and associations between red and processed meat and cardiovascular disease and certain types of cancer (Boada, Henríquez-Hernández, & Luzardo, 2016). Despite these guidelines, incidence of diet-related morbidity has risen, markedly. For example, between 1971 and 2011, fat consumption in the US dropped from 45% to 34%, while carbohydrate consumption increased from 39% to 51% of total caloric intake on average (USDA, 2020). Similarly, between 1972, and 2012, red meat consumption dropped by about 25% for the average American (USDA, 2020). These dietary changes have coincided with substantive increases in cardiovascular disease, diabetes, and obesity and overweight over the same period (CDC, 2017; Dehghan et al., 2017). Furthermore, a substantial body of evidence links increased carbohydrate consumption, particularly dietary sugars, to damaging health effects within a public increasingly affected by metabolic syndrome, obesity, (pre)diabetes, and related chronic illnesses (Kroemer, López-Otín, Frank Madeo, & Cabo, 2018). Other research claims that the relations between red (including processed) meat consumption and increased risk of chronic disease are based on low-quality evidence (Johnston et al., 2019); and that meat consumption provides a plethora of health benefits (Binnie et al., 2014; Dobersek et al., 2020).

Against a backdrop of inconsistent information and ongoing debates on the harms and benefits of animal-sourced food and fat consumption (e.g., Leroy & Barnard, 2020), some populations have been reducing their carbohydrate consumption to promote better health, leading to the popularity of low-carb and ketogenic-type diets (Giugliano, Maiorino, Bellastella, &

Esposito, 2018). Ketogenic-type diets limit, to various degrees, carbohydrate consumption, particularly high glycaemic carbohydrates and simple sugars (e.g., grains, fruits, starchy vegetables, high sugar beverages/foods). Instead, ketogenic-type diets prioritize foods higher in dietary fat and protein such as meat, poultry, fish, eggs, nuts and seeds, and full-fat dairy products (Wong, Raffray, Roy-Fleming, Blunden, & Brazeau, 2020). More ‘extreme’ versions of these diets are emerging, aiming to severely limit or entirely exclude carbohydrates for periods of time, colloquially labelled *zero-carb diets*. People eating zero-carb diets are known to consume, almost exclusively, animal-sourced foods (i.e., all types of meats and fish, eggs, and dairy), at the expense of plant-based foods (i.e., fruits, vegetables, legumes, and grains)¹. Broadly, people restricting carbohydrates induce, intentionally or inadvertently, *nutritional ketosis*, a physiological state in which the body reduces insulin secretion and switches to primarily using fat, instead of glucose, for energy (Giugliano et al., 2018). A carbohydrate reduction to *below* 150 grams per day is purported to lead to *nutritional ketosis*, and, therefore, diets restricting carbohydrate consumption to below the 150 grams per day threshold may be collectively called ketogenic-type diets² (Westman et al., 2007). Ketogenic-type diets have been linked to adaptive health outcomes, such as sustained weight loss, improved physique, reduced hunger, improved mood and cognition, better digestion, improved biomarkers, and higher quality of life (Dong, Guo, Zhang, Sun, & Chen 2020; Paoli, Rubini, Volek, & Grimaldi, 2013). In addition, a growing number of case reports suggest that ketogenic-type diets almost exclusively consisting of animal-sourced foods are effective in managing and even reversing chronic health conditions, including obesity, type 1 and 2 diabetes, Crohn’s disease, and epilepsy (Tóth & Clemens, 2015).

¹ A tentative definition for participation inclusion purposes was derived from dietary habits reported in a long-standing online zero-carb community: <https://www.zerocarbhealth.com/what-can-i-eat-on-a-zero-carb-diet/>

² In the present manuscript we use the term *ketogenic-type diets* to collectively refer to diets that restrict carbohydrate consumption.

Zero-carb diets are gaining prominence but there has been, to date, no published empirical research on the factors that influence people to take up, and remain committed to, a zero-carb diet (Leroy, 2019). There is also no empirical a research on the shared definitions and features of a zero-carb diet among those who follow them, which is important in order to document typical practices, and inform research on potential health benefits and risks. However, the rise in popularity of zero-carb diets in media outlets has created substantive need for information for those already following these diets and those interested in taking up the diet in the future. The limited research on zero-carb diets presents challenges to health-care professionals (e.g., physicians, nutritionists, psychologists) interested in establishing the factors that determine the diet uptake, and supporting people on the diet. Furthermore, the need for research in this area is important given the increasing evidence that carbohydrate-restrictive diets have beneficial health effects.

The current study aimed to fill this evidence gap by exploring the beliefs and experiences of adults on zero-carb diets. Specifically, we were interested in identifying the common shared knowledge and understanding of what characterizes a zero-carb diet. We also aimed to identify the sets of beliefs that underpin people's decisions to begin and maintain a zero-carb diet. Our approach was guided by social psychological theory, particularly the theory of planned behavior (Ajzen, 1991). The theory stands as a leading approach to identifying belief-based determinants of behavior, particularly through the systematic elicitation of sets of beliefs that underpin people's motives or *intentions* to perform a behavior (Hagger, Chan, Protogerou, & Chatzisarantis, 2016; Jemmott et al., 2011; Mougkridou & Protogerou, 2014). According to the theory, people's intention to perform a behavior is governed by three sets of salient beliefs: behavioral, normative, and control beliefs (Ajzen, 2002). *Behavioral* beliefs refer to perceived advantages and disadvantages of adopting a behavior; *normative* beliefs refer to individuals or

groups that are perceived to influence the adoption of a behavior; and *control* beliefs refer to factors that are perceived to facilitate or inhibit the adoption of a behavior. Normative beliefs also encompass *descriptive norms*, reflecting individuals' identification with specific groups of people who also perform the behavior in question. Collectively, these beliefs provide important information on the considerations people weigh up when making decisions to act (Ajzen, 2002). These salient beliefs are elicited through qualitative research (Ajzen, 2002). Given the dearth of empirical research on zero-carb diets, we used a qualitative survey design to gain in-depth understanding into the beliefs and experiences of those eating zero-carb diets.

2. Method

2.1. Participants and recruitment

Participants ($N = 170$) were recruited from Twitter, an online social media and micro-blogging site. Twitter has become a popular platform for social research, as it offers recruitment advantages including reduced costs and access to specific, large, hard-to-reach populations that are geographically and culturally diverse (Wasilewski, Stinson, Webster, & Cameron, 2018). A 'tweet' is a message posted on the platform and can act as an online advertisement of a study. When a study advertisement is "retweeted" (shared) with the online community mentioning the target population, it reaches the target population (Hendricks, Düking, & Mellalieu, 2016). The use of personal Twitter accounts that are active and have many followers are seen as trustworthy by potential research participants, and likely to result in higher recruitment and participation rates (Hendricks et al., 2016; Wasilewski et al., 2018). At the time of data collection, the three authors' Twitter accounts were active daily and totalled over 7,000 followers. Data were collected by the first author and data collection lasted 10 days. To be included, participants had to be adults (≥ 18 years) following a zero-carb diet for at least six months prior to the date of data-collection. This

6-month cut-off was set to exclude people that may have been following the diet capriciously and/or without substantial personal investment.

2.2. Design and procedure

The current study was a qualitative survey, developed with Qualtrics, a web-based survey tool. The study advertisement was tweeted by the first author and subsequently re-tweeted by the two co-authors. The study advertisement was also “pinned”, i.e., prominently situated on the first author’s Twitter account during the recruitment period. The advertisement invited adults who had been eating a zero-carb diet for at least 6 months to participate in a study “on zero-carb eating”. The invitation asked potential participants to contact the first author (through Twitter’s messaging function) to learn more about the opportunity to participate in the study. Interested participants who contacted the first author were provided an anonymized link that offered access to the online survey. Ethical approval of the study was granted by the Ethics Review Committee of the [University omitted for masked review] in April 2019 (reference number: PSY2019-012). We disclose that the first author’s interest in this topic was prompted by their own experiences with a zero-carb diet. Study design development was guided by an early version of Protogerou and Hagger’s (2020) quality criteria for survey studies.

Study materials are available on the OSF platform: [OSF | Factors associated with the decision to eat a zero-carbohydrate diet.](#)

2.3. Measures

The online survey comprised three sections. The first section provided participants with information on the study and the consent form, followed by questions capturing participants demographic details: age, gender, country of residence, highest education level, occupation, mental health condition diagnosis, and disordered eating status. Disordered eating was measured using the Eating Disorder Screen for Primary Care (ESP; Cotton, Ball, & Robinson, 2003); an

established screening tool that has been used across settings and populations (e.g., Thorsteinsdottir & Ulfarsdottir, 2008). The ESP comprises four questions (e.g., “Are you satisfied with your eating patterns?”) measured by a binary yes/no response scale. More than two ‘abnormal’ responses – a ‘no’ response to the first item and a ‘yes’ responses to others, is considered as a positive screen for an eating disorder.

The second section included open-ended questions focused on eliciting participants’ beliefs about their zero-carb diets, based on the theory of planned behavior. The questions asked respondents to provide, in relation to eating a zero-carb diet, perceived advantages and disadvantages (behavioral beliefs); approval and disapproval from significant others, such as family, peers, organizations, (normative beliefs); influential others also following the diet (descriptive norms); and the facilitating/ inhibiting factors (control beliefs). In separate questions, participants were asked to identify their “top three most important beliefs” for each belief category. Lastly, intentions to continue eating a zero-carb diet in the future were recorded.

The third section was an open-ended question encouraging participants to provide additional comments and thoughts on zero-carb eating. Upon completion, participants were directed to a debriefing page. The full survey is available online: [OSF | Factors associated with the decision to eat a zero-carbohydrate diet](#)

2.4. Data analyses

Participants’ responses to scaled survey items were summarized using means, standard deviations, and percentages. Participants answered open-ended questions in their own words and in as much depth as they chose. Responses to open-ended questions were high in volume and density; for example, participants’ responses to *each* open-ended question resulted in a minimum of 25 single-spaced pages (> 10,000 words) of data. Data from open-ended questions were used verbatim to preserve participants’ personalized expression style. Responses to the open-ended

beliefs items were analysed using inductive and deductive thematic analysis following processes described by Elo and Kyngäs (2008) and Braun and Clarke (2006).

Thematic analyses are systematic ways of analysing data aimed at producing a “...condensed and broad description of the phenomenon, and the outcome of the analysis is concepts or categories describing the phenomenon” (Elo & Kyngäs, 2008, p. 108). In the current study, this focused on identifying themes reflecting participants’ beliefs and experiences with respect to eating a zero-carb diet, and their definitions of a zero-carb diet. *Inductive* thematic analyses involve moving from the *specific* to the *general*, whereby instances of interest (e.g., recurring pieces of conceptually relevant information provided by participants) are observed and synthesized into larger wholes or general statements (i.e., codes, subthemes, and themes). Inductive thematic analyses go beyond summarizing and presenting participants’ responses to *interpreting* patterns of participants’ responses (Braun & Clarke, 2006; Elo & Kyngäs, 2008). Our a priori decision was to code responses to the point of theoretical saturation and to include at least 30% of participants’ responses ($n = 51$) to ensure adequate coverage of participants’ beliefs. Similar cut-offs have been followed in other theory of planned behavior-based elicitation studies (e.g., Quinton & Brunton, 2018). Theoretical saturation is the point at which no new concepts emerge from the reviewing of successive data (Bradley, Curry, & Devers, 2007). Across themes, theoretical saturation was observed well before coding the final participant’s responses, but we continued coding to ensure that saturation. We conducted a separate thematic analysis on *every question* asked, resulting in different sample sizes for the themes emerging from each question. *Our unit of analysis was the response* – a complete participant quotation.

Compared to inductive thematic analyses, deductive thematic analyses are less interpretative, focusing on summations or summaries of participants’ responses, and identifying the most ‘popular’, ‘prominent’ and ‘frequent’ (patterns of) responses (Elo & Kyngäs, 2008). Our

deductive thematic analyses identified participants' salient beliefs – the most frequently mentioned beliefs regarding zero-carb diets and those which participants considered of highest importance, following procedures by Francis et al., (2004). To elicit behavioral, control and normative beliefs with respect to a behavior, Francis et al. recommended one content-analysis of data from a sample size of twenty-five and listing the beliefs in order of frequency. While we broadly followed this procedure, our sample sizes were larger than twenty-five aiming to ensure theoretical saturation in topics that were not empirically explored before. We first asked participants to freely provide their beliefs and then to decide on their 'top three' most important behavioral, normative/descriptive norm, and control beliefs. We focused on extracting the most frequently cited 'top three' beliefs, which we categorized under the theory of planned behavior belief-based headings (Table 4).

ThematiCoder v.1.0 (Chan, 2012) was used to organize the thematic analyses. ThematiCoder 1.0 is a software application that enables the recording and coding participant quotations and themes, while automatically calculating and displaying useful statistics, such as number, percentage, and coverage of quotes within and across codes or themes. The ThematiCoder v.1.0 spreadsheets used in the current study are available online: [OSF | Factors associated with the decision to eat a zero-carbohydrate diet](#)

Thematic analyses were conducted by the first author and reviewed against Braun and Clarke's (2006) 15 criteria for a high quality thematic analysis by the second and third author. These criteria appraise aspects of all stages of thematic analyses (e.g., thoroughness, inclusiveness, and comprehensiveness of codes; coherence and distinctiveness of themes; interpretation of data instead of description of data; representativeness of quotations; consistency between stated methods and reported findings; transparency of the written report). All quality criteria were met in the present study.

3. Results

3.1 Participant characteristics

Participants comprised one hundred and seventy adults ($M = 42.82$ years of age, $SD = 12.05$) from twenty-five countries. There was no evidence of disordered eating in the sample, and only a small number of participants ($n = 15$, 8.82%) reported being diagnosed with a mental health condition at the time of data collection. Completion rate, i.e., extent to which participants completed the questionnaire, was very good (78%). Technical issues relating to WIFI/internet connectivity and computer malfunction, were reported as reasons for non-completion. All but one participant ($n = 169$, 99.41%) reported intentions to continue the diet indefinitely. Detailed participant information is presented in Table 1.

3.2. Thematic analyses

Thematic analyses were structured under three overarching categories—diet definition, lived experiences with the diet, and modal beliefs— each incorporating a set of themes.

3.2.1. Zero-carb diet definition

Participants defined their diets in terms of types of foods consumed but also in terms of daily, weekly, and even yearly routines relating to the diet. We describe participants' conceptualization of their diet is under three headings/ themes: *meat and water first*; *idiosyncratic eating*; and *slowly meeting meat*. Themes and illustrative quotations describing the zero-carb diet are presented in Table 2.

3.2.1.1. Theme: Meat first

Overwhelmingly, participants ate a wide variety of animal-sourced foods at every meal, particularly meats and organs (e.g., beef, pork, poultry, sheep, organ meats, game); eggs; dairy products; fish and seafood. The most popular food choices were beef cuts (98.12% coverage across quotations); followed by fatty fish (72.12%); pork cuts (64.11%); eggs (62.65%); dairy

products (55.94%); poultry (51.28%); organ meats (40.29%); animal fats (39.03%); cold meat cuts (26.81%); and shellfish (17.36%). Spices were used in cooking (37.93% coverage across quotations), with salt most frequently mentioned. Foods were also eaten raw (19.22% coverage across quotations). Dietary supplements were generally not popular (7.56%), but some participants mentioned taking vitamins, minerals, collagen powder, and organ meats in capsule form. Water – including mineral and carbonated water – was the beverage of choice (42.73% coverage across quotations), followed by coffee (39.08%); alcoholic drinks (18.44%); tea (15.14%); and sugar-free soft drinks (3.28%) (Table 2: P1, female, aged 55, USA).

Non-animal sourced foods with carbohydrate content were also eaten on occasion, including fruits (11.33% coverage across quotations); dark chocolate (7.74% coverage across quotations); honey (6.03% coverage across quotations); and vegetables (5.41% coverage across quotations). Deviations from animal-sourced foods were, however, rare and typically occurring in social situations where participants felt pressured to eat what others were eating. Some participants deliberately scheduled eating foods with higher carb content, describing these instances as “cheats” or “treats” from their usual diets (Table 2: P1, female, aged 55, USA; P2, female, aged 49, UK).

3.2.1.2. Theme: Idiosyncratic eating

Participants’ eating patterns were idiosyncratic. Many did not have fixed eating time schedules, mentioning that they would eat when hungry and ‘to satiety’. Related, participants explained that their chosen foods kept them sated for long periods of time, and as a result, they ate once or twice a day. Some participants described this eating pattern as intermittent fasting, one-meal-a-day or OMAD or, simply, fasting (29.12% coverage across quotations). Other participants mentioned having breakfast, lunch, brunch, and dinner, but those terms were not used in the traditional sense, as the same types of foods were consumed regardless of time of day.

Also, some participants snacked, but snacks were the same foods eaten during meals (Table 2: P3, male, aged 34, Germany; P4, male, aged 42, New Zealand).

3.2.1.3. Theme: Slowly meeting meat

For many participants, the decision to uptake a zero-carb diet was the culmination of a slow and gradual process, where carbohydrate consumption was steadily reduced. Participants typically ended up eating a meat-heavy diet, after having spent a substantial amount of time, sometimes years, eating ketogenic-type diets. Progressively excluding carbs while increasing meat and other animal food content was experienced as a *natural, logical, and considered* process. This was because the diet was adjusted based on conducting personal research on, and experimentation with, various foods and noting the physical and emotional responses to the foods (Table 2: P5, male, aged 32, Greece).

3.2.2. Lived experiences with a zero-carb diet

Participants' experiences with the diet are reported under three headings/themes: *wellbeing and quality of life, challenges, and internet families*. Themes and illustrative quotations from participants' lived experiences with the diet are presented in Table 3.

3.2.2.1. Theme: Wellbeing and quality of life

All participants' wellbeing and quality of life improved since uptaking the diet. Improvements related to health; interpersonal relationships; learning and growth; and simplicity and independence. The improvements are fleshed out below.

A plethora of physical and psychological health benefits were attributed to the diet. *Physical* health benefits related to the digestive system (e.g., reduction or elimination of irritable bowel syndrome symptoms); integumentary system (e.g., smoother skin, stronger hair and nails); and musculoskeletal system (e.g., reduced joint and back pain). Furthermore, participants experienced improvement in metabolic health (e.g., blood pressure, glucose, insulin, and thyroid

function, as evidenced by biomarkers); and sex drive. *Psychological* health benefits included improvements in mood and cognition, including reduction in anxiety, depression and tiredness; increased happiness and joy, confidence, self-esteem, mental clarity, memory function, sleep quality, and productivity at work. Participants also experienced joy by eating the foods (e.g., the taste and texture was inherently pleasurable). Furthermore, some participants mentioned that the diet facilitated participation in health-promoting behaviors, specifically exercise and fasting. During exercise, participants felt stronger and more energized, but also, experienced the benefits of exercise more pronounced (e.g. more muscle-building) (Table 3: P6, male, aged 58, South Africa; P7, male, aged 28, USA).

Preoccupation with the diet was also reported to foster the development of relationships with like-minded people. Participants sought out, interacted with, and formed, zero-carb networks, some as in-person groups, but mostly through online platforms and social media. The networks included a diverse international community of people from multiple educational and occupational backgrounds. These relationships were important sources of acknowledgment, approval, support, and motivation for study, research, and personal experimentation with the diet. In the absence of published research on the diet and the divergence from mainstream food recommendations, participants relied heavily on their networks to receive and share information. The diet was often tweaked, as a function of continued study, self-experimentation with foods, and information-sharing with the networks. However, participants' relationships and daily interactions with their immediate social circles (e.g., spouse, close friends, close family members, co-workers) were also important sources of support and influence in terms of adhering to the diet (Table 3: P8, female, aged 35, Australia).

A dimension of the diet contributing to participants' quality of life was the simplicity of the diet. Participants explained that the diet saved them time in shopping and cooking the foods,

but also money. The minimalistic nature of the diet seemed particularly suitable to those who were autonomous and independent in terms of character, living and working conditions, and seeking out, using, and assimilating health-related information. The diet seemed to attract independent people but also to strengthen existing independent tendencies (Table 3: P9, female, aged 51, Canada; P10, male, 36, The Netherlands).

3.2.2.2. Theme: Challenges

In parallel with improvements in wellbeing and quality of life, participants were challenged in their pursuit of excluding carbohydrates and prioritizing animal-sourced foods. The challenges, fleshed out below, were *interpersonal*, *structural*, and *internal*, in nature.

Disclosing the nature of their diet and the larger goal of excluding carbohydrate intake altogether, strained *interpersonal* relationships. Participants understood that their chosen eating style was largely socially unacceptable, socially isolating, and eliciting responses that tended to be stigmatizing. The term ‘social stigma’ was used by participants themselves to describe reactions they commonly received from others that were following conventional eating patterns. Participants felt ‘tired’ or ‘fed up’ having to explain their eating preferences to others, especially since their explanations would often lead to heated debates and arguments. Furthermore, in social situations, participants were often pressurized to eat foods with high sugar and carbohydrate content. Participants believed that *almost everyone* disapproved of their chosen way of eating (Table 3: P11, male, aged 27, UK).

Participants also experienced *structural* challenges to the diet, that is, societal, financial, infrastructural, and policy-related obstacles. Participants understood that *society* or *the environment* was generally structured to facilitate consumption of foods high in sugar and carbohydrates, and, consequently, made consumption of zero-carb foods particularly difficult. These structural barriers reflected broad, interlinked ideological and educational systems, policies

and industries, and infrastructures. For example, participants argued that medical and nutritional education prepared physicians and dieticians, as well as the organizations that these health experts belonged to, to strongly disapprove of diets heavy in animal-sourced foods. Instead, health-related systems collectively promoted foods higher in sugars and carbohydrates. Related, participants observed how the food industry produced and advertised foods high in sugar and carbohydrates. The restaurant and wider hospitality industry, as well as supermarkets and grocery stores, also posed obstacles to the diet, given their heavy emphasis on high-carbohydrate foods. Eating out of the home (e.g., in restaurants, while traveling, at work, on business meetings) was particularly challenging to participants due to limited provision and the high cost of animal-sourced foods. It was also mentioned that many organizations and groups popularize ideologies that portray meat and animal-sourced diets as harmful. These organized groups, vegetarians, vegans, animal rights advocates, and environmentalists, were additional challenges to zero-carb diets. Furthermore, participants understood that social media, advertising, and film industries promoted diets high in carbohydrates and raised concerns over diets based on animal foods (Table 3: P12 male, aged 60, USA; P13, female, aged 49, USA).

Lastly, participants experienced *internal* challenges relating to the diet. Specifically, some experienced physiological discomfort upon trying a zero-carb diet for the first time, often described as “the adaptation phase” or “keto flu”. Similar symptoms were also experienced when deviating from the diet once past the adaptation phase. This discomfort was typically transient, and related to gastrointestinal reactions, but also to “immunological” and “psychological” reactions. The diet also resulted in some participants being “more sensitive” or “less tolerant” to eating foods high in carbohydrate content. Other participants noted feeling bored with the limited food options available to them, as well as uncertain about long-term consequences of the diet

given the lack of published research on it (Table 3: P14 male, aged 34, USA; P15, female, aged 40, UK).

3.2.2.3. Theme: Internet families

Social interactions through various online platforms emerged as a pervasive influence on participants' diets. Nearly all participants were influenced to uptake the diet by an online advocate of the diet. High-profile zero-carb diet advocates vocal on social media were a primary source of information, influence, and support. These advocates included health care experts, including physicians, academics, researchers, and dietitians, but also, people with very little or no health-related training or expertise. Participants listened to podcasts, watched *YouTube* clips, and read websites and blogs that were dedicated to the diet. Many participants were members of zero-carb or 'carnivore' communities on social media platforms. Through membership to these online communities, participants met and interacted with like-minded people who also followed the diet. A sense of belonging to an online community, or online 'family', was an important aspect of participants' lives. The internet was also the primary space for obtaining and sharing knowledge on zero-carb diets. For some participants, these online communities were the only source of information and support in relation to their diet, given the limited acceptance of the diet in real-life social circles. Belonging to these online zero-carb communities, expressing and sharing values, beliefs and practices, suggests an emergent zero-carb group identity (Table 3: P16, male, aged 33, UK; P17, female, aged 51, Canada; P18, female, aged 37, UK).

3.2.3. Modal beliefs

Participants nominated their top three most important behavioral, normative, and control beliefs for following a zero-carb diet. These beliefs are presented in Table 4 in order of frequency alongside illustrative quotes.

Improved physical health, mood/cognition, and physique were the most frequently reported advantages of the diet. Social stigma and interpersonal challenges, eating out challenges, and boredom due to limited variety in the foods, were the most frequently reported disadvantages (Table 4: P19, female, aged 46, USA; P20, male, aged 21, Denmark; P21, male, aged 31, USA; P22, female, aged 29, Germany; P23, male, aged 43, UK).

Romantic partners, close family members and zero-carb advocates on social media were nominated as the most important sources of approval of the diet. Close family members were seen as important sources of disapproval too, as were physicians. Notably, the most widely reported negative referent was “nobody”, with participants explaining that, ultimately, others’ disapproval of the diet did not matter to them (Table 4: P24, female, aged 49, USA; P25, male, aged 26, USA; P26, male, aged 52, UK; P27, female, aged 51, Canada; P28, female, aged 52, Australia; P29, male, aged 59, Canada; P30, male, aged 51, USA; P31, female, aged 55, USA; P32, female, aged 61, USA).

Factors making the diet easier to follow included the experience of wellness, the ease and simplicity of the diet, and the enjoyment of the foods consumed. Factors making the diet harder to follow included eating-out challenges, social stigmas, interpersonal challenges, and higher costs of zero-carb foods (Table 4: P33, male, aged 24, USA; P34, male, aged 37, South Korea; P35, male, aged 37, USA; P36, female, aged 58, Canada).

4. Discussion

The present study systematically explored beliefs and experiences of people eating a zero-carb diet for a minimum of six months. The research adopted a qualitative survey design with data collected from Twitter. Participants were asked to describe and elaborate on the advantages, disadvantages, normative influences, and facilitators and detractors of eating a zero-carb diet. Data were thematically analysed.

4.1. Zero-carb diet: definition and quality of life

A basic definition of a zero-carb diet emerged based on the shared dietary habits reported by participants. According to participants, a zero-carb diet involves consumption of a variety of foods that are predominately, but not exclusively, animal-sourced. The types and amounts of foods consumed, as well as the timing of the meals, was idiosyncratic. ‘One’, singular, zero-carb diet did not emerge and therefore, the term ‘zero-carb diet’ does not refer to a specific, clearly-bound set of foods, macronutrient ratios, or the complete elimination of carbohydrates. While the label zero-carb diet is empirically imprecise, we still view it as an apt global term. This is because it captures participants’ shared understanding of the development and evolution their dietary practices, their goal to reduce carbohydrate intake to a bare minimum, and the psychophysical changes resulting from carb restriction/exclusion. For example, many participants in the current study described a process of gradual carbohydrate reduction, originating from a paleo, low-carb, or ketogenic eating style. This suggests a *continuum* of carbohydrate restrictive diets, with zero-carb variants located at the extreme end of the continuum. Participants reported that they arrived at a zero-carb variant that suited them and gave them the most health benefits, through personal study, food experimentation, and interaction with like-minded people.

The underlying physiological mechanism primarily put forth to explain health-related benefits of carbohydrate restriction is nutritional ketosis (Castro et al., 2018). In the present study participants were experiencing a wide variety of health benefits that they attributed to their diet, including better digestion, better metabolic health biomarkers, weight loss, vitality, reduced hunger, improved mood, and social relationship development. These benefits are consistent with research on nutritional ketosis in populations eating ketogenic diets (see Castro et al., 2018; Paoli et al., 2013; Wong et al., 2020). Furthermore, the avoidance of so-called plant antinutrients, such

as phytates, lectins, oxalates, and fiber, has also been proposed as a factor explaining health benefits experienced through carbohydrate restriction (Saladino, 2020).

A notable finding from the current data is that a zero-carb diet also seemed to covary with fasting, another dietary practice known to facilitate ketosis. Many participants in the present study reported reduced meal frequency, to two and, even one, meal per day. Evidence on fasting practices are consistent with nutritional evidence on the health benefits of ketosis outlined previously (Bagherniya, Butler, Barreto, & Sahebkar, 2018; Mattson et al., 2018).

4.2. Challenges

The zero-carb diet introduced important challenges to participants' lives. Some of the challenges were relatively innocuous daily hassles, such as eating out and shopping challenges, and boredom due to limited food types consumed. Other challenges were more serious, with potentially negative health implications, such as facing social stigma, strife in interpersonal relationships, lack of guidance and support from health-care providers, adverse physiological symptoms, and worry about the long-term healthfulness of the diet. Nevertheless, participants framed challenges as transient or not significant enough to derail maintaining their diet. If anything, overcoming these challenges appeared to bolster participants' resolve in adhering to the diet. All but one participant reported intentions to follow the diet indefinitely, and most reported that others' disapproval of the diet did not matter enough to stop them. Participants largely overcame challenges through personal research and experimentation with foods, and closely interacting with online communities, often described as 'families'. These findings are congruent with other research on individuals following ketogenic-type diets reported a strong desire to continue with the diet, despite similar challenges (Kianpour, 2020; Wong et al., 2020). It appears that a strong group identity based on adherence to so-called unconventional diets helps to override or negate challenges, through bonding among group members over shared values, goals,

and outcomes of the diet. Comparable experiences have been reported by individuals following vegetarian and vegan diets, with a substantive body of research documenting strong, cohesive social identities among individuals identifying as vegetarian and vegan (Nezlek & Forestell, 2020; Ruby, 2012). By contrast, research into a ketogenic social identity is scarce, although there are some preliminary studies (see Kianpour, 2020; Webster & Gabe, 2016). While the present study did not specifically set out to identify a zero-carb identity, a key emergent finding from our data suggest that such an identity appears to exist.

4.3. Modal salient beliefs

Participants' top three ranked salient beliefs shed light into the important motivators, facilitators, and shortcomings of eating a zero-carb diet. Participants' beliefs revealed that the benefits of the diet were also what made the diet easiest to follow. Improvements in physical health, mood, cognition, and body composition, the simplicity of the diet, as well as joy derived from the foods consumed, were factors of high importance to participants. Also, of primary importance was the validation of romantic partners, close family members, and expert social media advocates of the diet. Participants were typically introduced to a zero-carb diet by a prominent social media figure who openly promoted the diet and ate the diet. Participants trusted, respected, and relied on those figures for support and information. Still, participants were explicit in their conviction that, ultimately, they did not rely on the approval or disapproval of any particular person or group when it came to continuing with their diet. Participants came across as highly autonomous and intrinsically motivated in terms of maintaining their diet. Important obstacles to the diet included limited availability and high cost of zero-carb foods when eating out, as well as the toll of the diet in real-life interpersonal relationships. However, these obstacles, while frustrating, were not sufficient to derail adherence to the diet. To the contrary, participants adopted strategies to overcome the obstacles to maintain the diet.

4.4. Implications for research and practice

Based on the present findings, we recommend additional research in several domains. First, we recommend research into the safety and efficacy of excluding or severely limiting carbohydrates for extended periods of time. Our data indicate that people eating zero-carb diets for at least six months experience important benefits but also shortcomings, all of which warrant further investigation, especially through clinical trials.

Based on the current data, we note that people eating zero-carb diets are unlikely to receive support and care from conventionally-trained health professionals, who have not received specific training on these dietary practices or have insufficient background information on the health and social implications carbohydrate restriction. The lack of support by health-care providers has also been documented for people on ketogenic diets (Wong et al, 2020).

Participants in the present study sought and depended on sources of information and support outside their regular health-care providers, typically from online zero-carb communities. While many in these communities may have appropriate backgrounds and knowledge of the diet, there is also a risk that people may receive information from sources that lack an evidence base or credibility. Given participants' expressed strong motives to adhere to the diet, with or without health-care provider support, we suggest that health-care providers seek to keep informed and upskill themselves to support this population. Furthermore, we argue for research into how health care professionals can support and monitor people on these diets.

We also recommend research into the formation of social identities based on carbohydrate restrictive diets. It is well established that food choices are a means to express personal values, beliefs and worldviews (Nezlek & Forestell, 2020). Our findings suggest that a zero-carb social identity exists. These findings are consistent with social identity theory (Tajfel, 1970), which suggests that people develop social identities based on the shared beliefs and attitudes of the

social groups to which they belong (ingroups), and that such identities are a source of motivation and self-esteem. Our participants shared values, beliefs and practices; belonged to ingroups based on their food choices and viewed these ingroups favourably. Although carbohydrate-restrictive diets have a long history, with formalized (medical) supervised plans appearing in the early 1990s (Freeman, Kossoff, & Hartman, 2007), the shared identity of people following these types of diets has been largely overlooked.

We also recommend research into how people eating zero-carb, and other carb-restrictive diets, manage to maintain their diets in face of challenges presented in the modern dietary landscape. One of the consistent barriers discussed by participants in the current study was the high availability of high-carb foods and beverages, and the relative lack of low-carb or zero-carb alternatives. Participants, like most people in Western nations, are consistently being marketed foods high in carbohydrates and sugars. Participants felt acutely that they were going against societal norms in their efforts to exclude carbohydrates, experiencing derision and stigma as a result. Exploring how those on zero-carb, and other carb-restrictive diets, navigate through and resist high-carb/sugar environments, can inform the development of strategies and interventions promoting consumption of alternatives to high-carbohydrate foods. Given the well-documented link between high carbohydrate consumption and metabolic health conditions like type 2 diabetes and obesity, such an approach is likely to have broad implications for health.

4.5. Strengths and limitations

The present study was the first to explore beliefs and experiences of people eating zero-carb diets and to elicit a definition of a zero-carb diet, filling an evidence gap. Other strengths of the study included the adoption of fit-for-purpose survey design based on social psychological theory, and recruitment of a large, international, and diverse sample of people who had been voluntarily on a zero-carb diet for at least six months, with a high completion rate. In addition,

the study design was developed based on criteria of the Quality of Survey Studies in Psychology (QSSP: Protogerou & Hagger, 2020), and analyses were appraised against Braun and Clarke's (2006) criteria for high quality thematic analysis. Finally, study materials, data files, and data analyses are openly available online ([OSF | Factors associated with the decision to eat a zero-carbohydrate diet](#)).

However, current findings should be considered in light of limitations. A potential limitation is self-selection bias. Participants volunteered their participation and were personally interested in the topic. Consequently, their views may differ from others on a zero-carb diet who did not elect to participate, and those who were not reached through our recruitment strategy. Self-selection bias is a methodological issue of concern in survey research that does not aim to recruit a random, stratified sample (Costigan & Cox, 2001). A related limitation is that our recruitment and sampling method did not allow us to estimate response rates, and, therefore we could not ascertain refusal rates, which may have provided an indication of the extent of self-selection. Although a random stratified sample is a research ideal, the current sample comprised participants from a highly-specialized group, presenting considerable challenges to such an ideal. Nevertheless, future research should consider strategies to reach zero-carb dieters who cannot be reached by social media, and those who are likely to refuse an initial invitation.

5. Conclusion

The current study contributes to knowledge by providing the first analysis of beliefs and experiences of individuals on a zero-carb diet, and their shared understanding of the diet. The research suggests that participants view a zero-carb diet as one that severely limits carbohydrate consumption, draws heavily from animal-sourced foods, and results in general wellbeing. Participants reported strong intentions to continue with the diet indefinitely, despite lack of published evidence on the diet, lack of support by health-care professionals and significant

others, and social stigmas attached to the diet. Furthermore, a zero-carb social identity appears to have emerged, facilitated by membership in online zero-carb communities. Based on these findings, we recommend further research into the long-term efficacy and safety of the diet, and the ways to support those wishing to uptake, maintain, or discontinue the diet. We also recommend research into the social identities of people on carb-restrictive diets, and the ways these identities shape initiation and adherence to the diets.

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Table 1

Sample Characteristics

Characteristic	Value	Characteristic	Value
Age <i>M</i>	42.82	Occupation	
<i>SD</i>	12.06	Managerial/Marketing/Sales	25 (14.70)
Gender		Health-care provider	18 (10.58)
Male	111 (65.29)	IT and programming	16 (9.41)
Female	58 (34.12)	Teacher/Professor	16 (9.41)
Other	1 (0.59)	Engineer	12 (7.05)
Country of residence		Technician	11 (6.47)
USA	87 (51.17)	Artist	9 (5.29)
UK	22 (12.94)	Administration	9 (5.29)
Canada	13 (7.64)	Self-employed	9 (5.29)
Australia	10 (5.9)	Services provider	7 (4.11)
South Africa	6 (3.52)	Business/Finance	9 (5.29)
The Netherlands	5 (2.94)	Retired and homemakers	6 (3.52)
Germany	3 (1.76)	Physicians	4 (2.35)
New Zealand	3 (1.76)	Attorneys/Solicitors	4 (2.35)
Denmark	2 (1.17)	Civil servants/Gov. employees	4 (2.35)
Finland	2 (1.17)	Languages	2 (1.17)
Greece	2 (1.17)	Consultants	2 (1.17)
Sweden	2 (1.17)	Tourism	2 (1.17)
Belgium	1 (0.58)	Unemployed	2 (1.17)
Brazil	1 (0.58)	Agriculture	1 (0.58)
Estonia	1 (0.58)	Statistician	1 (0.58)
Japan	1 (0.58)	Student	1 (0.58)
Mexico	1 (0.58)	Currently have mental health condition	
Norway	1 (0.58)	Yes	15 (8.82)
Russia	1 (0.58)	No	155 (91.18)
South Korea	1 (0.58)	ESP	
Spain	1 (0.58)	ESP item 1	169 (99.41)
Switzerland	1 (0.58)	ESP item 2	13 (7.65)
Taiwan	1 (0.58)	ESP item 3	115 (67.65)
Turkey	1 (0.58)	ESP item 4	24 (14.12)
United Arab Emirates	1 (0.58)	Intention to continue a zero carb diet	
Highest completed education level		Yes	169 (99.41)
University	123 (72.35)	No	1 (0.59)
Non-university higher education	24 (14.12)		
High-school	18 (10.59)		
Elementary school	1 (0.59)		
Other	4 (2.35)		

Note. Values represent numbers of participants with percentage in parentheses unless otherwise specified. ESP = Eating Disorder Screen for Primary Care.

Table 2

Zero Carb Diet Definition

Themes	Illustrative quotes
Meat first	<p>“Beef rib eye steak every day...Occasionally a few seared shrimps, scallops or oysters with it. Raw beef liver weekly. Sushi twice a month or so including salmon, yellow tail, squid. Biltong made from beef chuck and salt for travel or lunch at work. Water to drink. Very occasional fizzy mineral water but mostly flat well water. Salt. Bone broth every evening home made with a pressure cooker from beef feet and home grown chicken. Served with salt and a tablespoon of collagen powder. Oysters on the half shell about once a month” (P1, female, aged 55, USA).</p> <p>“...Rarely, I eat strawberries, raspberries and blueberries. I occasionally eat a couple of squares of dark chocolate as a treat...” (P2, female, aged 49, UK).</p>
Idiosyncratic eating	<p>“I eat one-meal-a-day (OMAD) at least 4 days per week. Only eating when hungry and sometimes fasting for 48 hours” (P3, male, aged 34, Germany).</p> <p>“Breakfast: Beef liver (about 300 g), grilled with butter; glass of cold-brew coffee. Lunch: Beef sirloin steak (about 300 g), fried in butter; glass of water. Dinner: Beef sirloin steak (about 300 g), fried in butter; glass of water” (P4, male, aged 42, New Zealand).</p>
Slowly meeting meet	<p>“The first 2 years were mostly revolving around the so called “classical bodybuilding” diet...I slowly veered away from lean meats and went...towards a ketogenic diet. Since February 2019, I have been on a Carnivore Diet, removing ALL fiber...” (P5, male, aged 32, Greece).</p>

Note. P = Participant.

Table 3

Lived Experiences with Zero-Carb Diet

Theme	Illustrative quotes
Wellbeing	<p>“My overall health has drastically improved. I had constant stomach issues eating even small quantities of vegetable and these have basically gone after going zero-carb. Depression and brain fog have gone and probably for these reasons alone I will not change the way of eating” (P6, male, aged 58, South Africa).</p> <p>“Best physique of my life, despite spending less time lifting weights daily than I had for the previous 8 years (and without any steroids or supplementation) - strongest I've ever been in my life even with less time in the gym - lowest body fat I've ever been without even actively trying to lose weight/fat” (P7, male, aged 28, USA).</p> <p>“I developed connection with like-minded individuals in the zero carb community. Opened my eyes to what ‘healthy’ really can be. gained an increase in knowledge of health, wellness, diet and lifestyle (and I am constantly learning and evolving, daily)” (P8, female, aged 35, Australia).</p> <p>“I am a widow and live alone so no one else to cook for or eat with most of the time I'm 51 and care less about what others think. The meat I eat is easily accessible to buy and cook and financially affordable” (P9, female, aged 51, Canada).</p> <p>“I have a low need for social validation and interaction - Financially well off enough to make it affordable - Enough intellectual and education background to trust my own research” (P10, male, 36, The Netherlands).</p>
Challenges	<p>“It is socially quite paralysing, unless you make an effort to find like-minded individuals with whom you could dine...As you are deviating from societal norms, you attract lots of derision from friends and family - You don't feel like you belong quite as much on sociable occasions when you choose to reject almost all food and drink on offer. Socially people are always trying to ‘talk me into’ carbs. ‘One bite won't hurt you’. ‘It's just a piece of cake, it won't make or break you’” (P11, male, aged 27, UK).</p> <p>“Any and all doctors, medical experts or nutritionists solely advocate a vegetable/carb-based diet” (P12, male, aged 60, USA).</p> <p>“It is difficult to order ‘meat only’ meals sometimes as people often get the order wrong...You pay the same price for just a meat only meal plate as a meat/side/bun/dessert meal plate” (P13, female, aged 49, USA).</p> <p>“I have less tolerance for non-ZC foods. Initially, diarrhea (1-2 weeks every other day), then normalized” (P14 male, aged 34, USA).</p> <p>“Options are severely limited. I occasionally get bored...” (P15, female, aged 40, UK).</p>

Internet
families

“The diet is not backed by a lot of scientific studies or research material, so it could be damaging in the long term” (P16, male, aged 33, UK).

“The support that I have found online has been paramount to my staying the course and adjusting my eating habits over time” (P17, female, aged 51, Canada).

“My Twitter 'family' of LCHF/Carnivore plays an important role in providing indirect support through information and general sharing of experiences” (P18, female, aged 37, UK).

Note. Illustrative quotes taken from open-ended survey question on behavioral beliefs. *Note.* P = Participant.

Table 4

Modal Salient Beliefs

Belief	Responses	Illustrative quotes
Behavioral/Attitudinal Beliefs: Advantages of zero-carb mattering the most	Physical health (71.69% coverage across quotations).	“no more eczema - no more PMS - strength and vitality” (P19, female, aged 46, USA).
	Mood and cognition (44.65% coverage across quotations).	“Better mental health: less mood swings, decreased anxiety, increased sense of wellbeing” (P20, male, aged 21, Denmark).
	Weight loss and body composition (37.83% coverage across quotations).	“No calorie counting, still lost weight” (P21, male, aged 31, USA).
Behavioral/Attitudinal Beliefs: Disadvantages of zero-carb mattering the most	Social stigmas and interpersonal challenges (65.69% coverage across quotations).	“It can feel socially excluding or awkward, not sharing cakes/pizza/beer when offered at social events. You are a minority group, and one that some people are openly hostile towards” (P22, female, aged 29, Germany).
	Boredom/feeling restricted due to the lack of variety of the foods (28.31% coverage across quotations).	“It's restrictive. No denying it” (P23, male, aged 43, UK).
	Eating out challenges (25.05% coverage across quotations).	“Paying the same for a full carb meal when only ordering meat. Social pressure to try and eat carbs. Getting my meals wrong when I order them (added sauces and hidden carbs that I request to be omitted)” (P24, female, aged 49, USA).
Normative beliefs: Others' (people, groups, organizations) approval of the diet mattering the most	Romantic partner (29.69% coverage across quotations).	“My fiancée My parents accept it (don't know about approve) All the guests on my podcast tend to approve” (P25, male, 26, USA)
	Close family members (29.38% coverage across quotations).	“I don't need approval to feel good! not a relevant factor for me” (P26, male, aged 52, UK).
	Social media expert advocates of zero-carb diets (25.84% coverage across quotations).	
	Nobody (25.13% coverage across all quotations).	

Normative beliefs: Others' (people, groups, organizations) disapproval of the diet mattering the most	Nobody (52.15% coverage across quotations) Physicians (18.46% coverage across quotations) Close family members including spouses, children and parents (13.49% coverage across quotations)	"Not trying to be glib here, but disapproval doesn't matter to me in that I will continue to pursue this course of action regardless of disapproval" (P27, female, aged 51, Canada). "My gp doctor" (P28, female, aged 52, Australia). My wife, mother and sisters. They were concerned about my health. My wife was concerned with the expense (P29, male, 59, Canada).
Normative beliefs: People, groups, institutions that influenced uptaking a zero-carb diet and who also follow the diet	Shawn Baker - medical doctor (62.61% coverage across quotations). Amber O'Hearn - independent health researcher (27.24% coverage across quotations). Kelly Hogan - teacher and moderator of online platforms dedicated to zero-carb eating (19.44% coverage across quotations).	"Dr. Shawn Baker is my biggest influence" (P30, male, aged 51, USA). "Amber O'Hearn was the key" (P31, female, aged 55, USA). "Kelly Williams Hogan (10 years ZC) drew my attention with her blog My Zero Carb Life" (P32, female, aged 61, USA).
Control beliefs: Factors making zero-carb easier to follow	The experience of improved health and wellness (56.86% coverage across quotations). The ease and simplicity of the diet (27.09% coverage across quotations) The enjoyment of the foods consumed (24.33% coverage across quotations).	"No bloating. The results. I can see How easy it is to make food" (P33, male, aged 24, USA). "Health, dental health, meat is delicious." (P34, male, aged 37, South Korea).
Control beliefs: Factors making zero-carb harder to follow	Eating out of one's home (67.22% coverage across quotations). Interpersonal challenges - toll on personal relationships, felt stigmas (40.27% coverage across quotations). The cost of foods (13.13% coverage across quotations).	"Meat prices - Traveling to places with noncarnivore options - Judgemental family" (P35, male, aged 37, USA). "Giving up going for supper with friends and going out for lunch with coworkers because they are all centered around foods that I no longer eat" (P36, female, aged 58, Canada).

Note. P = Participant.